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(54) TOOTH-SPARING OR NON-CARIOGENIC FOODS AND DELICACIES

(71) We, F. HOFFMANN-LA ROCHE & CO., AKTIENGESellschaft, a Swiss Company of 124-184 Grenzachstrasse, Basle, Switzerland, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to foods and delicacies; more particularly, it is concerned with tooth-sparing or non-cariogenic foods and delicacies.

It has been found that xylitol, which is a sugar alcohol, in contrast to the conventional sugars, which are ketones or aldehydes such as sucrose and glucose, and are usually used for human nutrition, neither promotes the growth of cariogenic bacteria nor is degraded by cariogenic bacteria to acids which, in turn, are the most fundamental causes of caries.

The present invention is accordingly concerned with tooth-sparing or non-cariogenic foods and delicacies which do not contain glucose or sucrose, comprising xylitol.

As foods and delicacies there will be understood foods and delicacies in solid, semi-solid or liquid form; for example, baked goods such as biscuits and cakes, creams, ice-creams and drinks such as syrups and fruit juices.

The present invention relates, in a particular embodiment, to tooth-sparing or non-cariogenic sweets, that is to say, to foods or delicacies with a high glucose or sucrose content such as, for example, hard and soft caramels (bonbons), fondant, foam-sugar goods, gum-sugar goods, liquorice goods, dragées, pharmaceutical dragées, pastilles, fruit pastes, chewing gum, croquant, effervescent powders, marzipan, persipan, nougat, ice-creams, jam and artificial honey in which the glucose or sucrose is replaced by xylitol.

A particularly preferred aspect of the last-mentioned embodiment relates to bonbons, particularly hard candies, in which the glucose or sucrose is replaced by xylitol.

The replacement of the glucose or sucrose by about equal amounts of xylitol is possible because xylitol displays about the same sweetening power as glucose and sucrose.

The foods and delicacies provided by the invention are manufactured by replacing the glucose or sucrose used in their manufacture by xylitol.

The following Examples illustrate the invention:

Example 1

Jam is manufactured, the sucrose conventionally used being replaced by the same amount of xylitol. Such a jam (for example, blackberry jam or quince jam) contains about 25 g of xylitol per 100 g.

Example 2

An effervescent powder of the following composition is manufactured:

Xylitol	903.2 g	
Tartaric acid	60.0 g	65
Sodium carbonate	35.0 g	
Orange aroma	1.5 g	
Dye	0.3 g	

Each 11 g of this powder are filled into aluminium sachets and the sachets are sealed. The content of one sachet suffices for the preparation of one glass (about 100 to 150 ml) of lemonade.

Example 3

Biscuits are manufactured, the glucose or sucrose conventionally used being replaced by xylitol.

Example 4

Hard candies are manufactured, the glucose or sucrose conventionally used being replaced by xylitol.

In the following Example it is shown that xylitol, in contrast to glucose, neither promotes the growth of cariogenic bacteria nor is degraded to acids by cariogenic bacteria.

Example 5

5 The growth of two strongly cariogenic Streptococcus strains was determined in 21 passages on a nutrient medium containing 0.5% by weight glucose, on a nutrient medium containing 0.5% by weight xylitol and on a sugar-free nutrient medium. The growth-intensity was determined with reference to transparency in a BAUSCH & LOMB

apparatus with filter 5300A in percentage comparison to an uninoculated control. 10

The degradation of glucose or xylitol was established with reference to the acid-formation by electrical pH measurement before and after incubation of the culture media for 24 15 hours at 37°C.

The results are summarised in the following Table:

TABLE

<i>Streptococcus mutans</i> (1st strain)					
Nutrient media	+ 0.5 % glucose % T*	pH**	+ 0.5 % xylitol % T	pH	sugar-free % T pH
Passages					
1st	6	-1.7	60	+0.3	30 +0.3
2nd	6	-1.8	76	0	53 0
3rd	5	-1.8	48	-0.1	36 -0.1
4th	5	-1.8	35	-0.2	36 -0.3
5th	5	-1.8	41	-0.1	41 -0.1
6th	4	-1.8	39	-0.1	39 -0.1
7th	3	-1.8	39	-0.1	34 -0.1
8th	4	-1.8	38	-0.1	33 -0.1
9th	4	-1.9	38	-0.1	36 -0.1
10th	5	-1.8	42	-0.1	35 -0.1
11th	4	-2.5	32	-0.1	37 -0.1
12th	4	-2.6	37	-0.1	32 -0.1
13th	4	-2.5	39	-0.1	39 -0.1
14th	4	-2.0	38	0	36 0
15th	4	-2.5	38	-0.2	36 0
16th	4	-2.6	32	-0.1	38 0
17th	4	-2.5	36	-0.1	36 -0.1
18th	4	-2.5	31	0	33 -0.1
19th	5	—	36	—	39 —
20th	5	-2.5	36	-0.1	36 -0.1
21st	4	-2.0	35	0	36 -0.1
<i>Streptococcus mutans</i> (2nd strain)					
1st	3	-1.7	51	+0.4	40 +0.3
2nd	5	-2.8	76	+0.1	62 +0.1
3rd	5	-1.9	73	0	69 +0.1
4th	6	-1.9	76	+0.1	67 0
5th	6	-1.9	70	+0.1	73 +0.1
6th	5	-1.9	67	+0.1	62 +0.1
7th	4	-1.9	71	+0.1	67 +0.1
8th	6	-2.0	72	0	66 +0.1
9th	6	-1.9	72	+0.1	70 +0.1
10th	6	-1.8	38	-0.1	60 +0.1
11th	3	-2.6	47	0	71 0
12th	3	-2.6	47	-0.1	65 +0.1
13th	3	-2.5	49	0	67 +0.1
14th	2	-2.7	54	+0.2	83 +0.1
15th	3	-2.5	60	0	59 +0.1
16th	3	-2.6	59	0	66 +0.1
17th	3	-2.6	55	0	66 0
18th	3	-2.5	35	0	62 +0.1
19th	3	—	51	—	64 —
20th	3	-2.5	47	-0.1	66 -0.1
21st	5	—	51	—	63 —

*% transmission (transparency)

** pH difference pH before inoculation and pH after incubation for 24 hours at 37°C.

From the foregoing Table it follows that the two Streptococcus strains grow extraordinarily well on the glucose-containing nutrient medium and ferment this nutrient medium to a normal degree. The acid which thereby results lowers the pH value by about 2 to 2.5 units.

In contrast thereto, the Streptococcus strains grow substantially less well on the xylitol-containing nutrient medium and there occurs practically no pH alteration.

This shows that the two strongly cariogenic Streptococcus strains are practically incapable of degrading xylitol.

Example 5

Normal feed "Altromin (Registered Trade Mark) R" (without addition of sugar), "Altromin R" + 5% by weight of sucrose, "Altromin R" + 10% by weight of sucrose, "Altromin R" + 5% by weight of xylitol and "Altromin R" + 10% by weight of xylitol were fed to rats. After 6-week experimental duration, the teeth of the rats were investigated for dentine lesions. The results are summarised in the following Table:

TABLE

Diet \ Type of Caries	Slight dentine lesions	Moderate dentine lesions
"Altromin R"	2.07	0.07
"Altromin R" + 5% sucrose	3.23	0.31
"Altromin R" + 10% sucrose	4.36	1.0
"Altromin R" + 5% xylitol	1.36	0.07
"Altromin R" + 10% xylitol	2.60	0.27

The foregoing numerical values were determined by quantitative counts of slight and moderate dentine lesions and are given in the Table in the form of indices which give a relative indication of the incidence of caries lesions observed in the test animals. They show that when feeding with xylitol-containing "Altromin R" diet the dentine lesions are in general no greater than with sugar-free feeding, whilst with sucrose-containing "Altromin R" diet dentine lesions occur substantially more frequently.

WHAT WE CLAIM IS:—

1. Tooth-sparing or non-cariogenic foods and delicacies which do not contain glucose or sucrose, comprising xylitol.

2. Tooth-sparing or non-cariogenic sweets which do not contain glucose or sucrose comprising xylitol.

3. Sweets according to claim 2 in the form of bonbons.

4. Sweets according to claim 2 in the form of hard candies.

5. Tooth-sparing or non-cariogenic foods and delicacies as set forth in claim 1, substantially as described with reference to the foregoing Examples.

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